HYDROGEN ISOTOPES AND RADIOGENIC HELIUM IN METAL MATERIALS

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When a metal is in contact with tritium-containing environments, there is inventory of radiogenic helium to build-up in it, which results from radioactive decay of the tritium absorbed in the metal. Also in this case, changes should occur (basically, degradation) in physical and mechanical properties of the metal, i.e. metal ageing, thus impacting its performance characterization. Investigating into the interaction of hydrogen isotopes and aged materials to provide knowledge on the performance characteristics of structural materials after their long- term operation in tritium- containing environments is of great scientific and applied interest.

The *study interaction of hydrogen isotopes with metals that have undergone accelerated ageing and have their performance characteristics qualified for long- term operation in tritium-containing environments* is planning. A so-called "tritium trick" will be used for accelerated accumulation of radiogenic helium in the materials of interest up to concentrations of 10^3- 10^4 appm. Basically, the idea is to hold the metal samples in tritium at high pressures and temperatures, when substantial quantities of tritium would be solution there, and its radioactive decay would result in build-up of helium. Provided these conditions, the metal would have an build-up of radiogenic helium accumulated over several months as large as that over 10 or more years of operation of a fusion reactor or any other tritium-containing installation.

The samples that will prepared such way will be used for:

- investigate into the hydrogen isotope transport, trapping and retention effects in metals with radiogenic helium content;
- investigate into the impact of radiogenic helium on the interaction behaviours of metals and non- equilibrium hydrogen isotopes, also including tritium;
- investigate the hydrogen isotopes and radiogenic helium synergistic effects upon mechanical properties of metals and structural materials.

This works are planning in the framework of the new ISTC project “Hydrogen isotopes and radiogenic helium in metal materials”.